

# AMERICAN JOURNAL OF PHARMACY AND THE SCIENCES SUPPORTING PUBLIC HEALTH

Since 1825

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Vol. 111.

OCTOBER, 1939

No. 10

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Annual Subscription, \$3.00

Foreign Postage, 25 Cents Extra

Single Numbers, 30 Cents.    Back Numbers, 50 Cents

Entered as Second-Class Matter at the Post Office at Philadelphia, Pa.,  
Under the Act of March 3, 1879

Acceptance for Mailing at Special Rate of Postage Provided for in Section 1103  
Act of October 3, 1917    Authorized February 15, 1920.

# E D I T O R I A L

On these pages the editor offers his opinions, unshackled by advertising patrons and unrestrained by anything save a sense of the decent and the truthful. The editor, alone, is responsible for their type, their tone and their tenor.

## BIOLOGIC CLEANLINESS

THAT oft-quoted phrase, that "cleanliness is next to Godliness," was devised long before the microscope was discovered, and "the odor of sanctity" was simply a polite way of referring to B. O.

Soap was not known to the ancients, who complicated their ablutions by only rarely bathing their bodies

with water but frequently anointing them with oils.

Antiphanes thus describes the bath of the Athenian dandy:

"He seldom bathes  
But in a gilded tub, and steeps his feet  
And legs in rich Egyptian unguents  
His neck and chest he rubs with ripe palm oil  
And both his arms with sweet extract of mint  
His eyebrows and his hair with marjoram  
His knees and face with essence of wild thyme."

To which we remark that the Greek dandy, according to our nose sense, must have presented out of his tub an anatomic ensemble that smelled somewhere between soap liniment and vegetable soup.

Certainly we are *cleaner* these days! And yet we have recently encountered two bits of annoying researches, both of which suggest that we are not half so clean as we like to think we are. For instance, a study conducted some time ago at the University of Nebraska in Lincoln indicated clearly the increment in bacteria that accumulate in undergarments as they are worn more frequently without washing. From an average count of about 400,000 per square inch after one use, the number increased to nearly 10,000,000 after the shirt was worn six times. The effect of laundering is represented by a reduced count of 1,000 or less. Washing alone is quite effective, but the drying process finishes the elimination satisfactorily. Sun drying is perfectly potent. The organisms present on worn shirts were those common to air, soil and skin. *Micrococcus albus* (*Staphylococcus*) and *M. aureus* were most frequently found; streptococci also were often present. The large number of hemolytic types observed suggests that underclothing should be changed

frequently and laundered by a process likely to check their development. Then there was a bacteriological and a chemical report on an old sweat leather from a well-worn hat. One-half of its weight was rancid perspiration grease and salts from the same source and the bacterial count was amazing. Indeed the leather band inside a hat is man's uncleanest bit of clothing.

All of which proves that our conception of cleanliness has greatly changed with the advance in knowledge of the kinds of dirt, the degrees of dirtiness and the nature of these hazards.

Biologic cleanliness is more important than esthetic cleanliness. On the other hand, much as we insist upon clean clothes over clean bodies, there is something to be said in favor of sensible skin laundering. In the morning paper last week we noted the following:

"Stop making fun of the Saturday night bath, you moderns, because grandpa had the right idea, after all.

"The daily cleansing may be all right for the young, but in the winter time the middle-aged should 'bathe once a week and be content with sponge baths in between times,' Dr. Paul A. O'Leary, retiring president of the American Academy of Dermatology and Syphilology declared yesterday.

" 'There's such a thing as trying to be too clean,' he warned at the closing session of the three-day convention, held in the Bellevue-Stratford. " 'Winter itch' is a common skin ailment, especially in middle-aged people. It is caused by the fact that during the winter, the oil glands of the skin are inactive. Soap and water, plus the dry heat of the house, dries out the skin, causing a condition that resembles chapping'."

So here is science upholding the Saturday night bath! By the way, is it not likely that over-bathing may wash off the natural greases and waxes, the cholesterol and other similar vitamin precursors so essential to skin nutrition and blood enrichment?

Too, is it not a fact that the bath-tub bath distributes vicious organisms common to certain naturally unclean parts of the body over the whole skin surface? Accordingly the cool shower bath seems most desirable!

However, a series of bacteriological examinations of bath-tub water before and after would be both interesting and instructive.

In the meantime, however, for our own comfort, as well as that of our associates—let us recall that soap is cheaper and saner than scent.

IVOR GRIFFITH.

## ORIGINAL ARTICLES

### ASSAY OF A SAMPLE OF OPIUM NINETY YEARS OLD

With some Remarks on the History of Morphinometric Assay

By Horatio C. Wood, Jr., M. D., Ph. M. and Arthur Osol, M. S., Ph. D.

**I**N 1853 Dr. Charles D. Meigs, then vice-president of the College of Physicians of Philadelphia, deposited in the museum of that institution a bottle containing a specimen of opium with the direction that the bottle should not be opened for fifty years. As far as we know the bottle was not opened until 1938, when Dr. Joseph McFarland, curator of the Mutter Museum of the College of Physicians, asked us to make an assay of this sample, suggesting that it might afford some information as to the likelihood of deterioration of this valuable medicament.

#### Biographies of the Depositors

Dr. Charles D. Meigs had a remarkably varied career. Born of old New England stock in one of the Bermuda islands in 1792, he spent most of his childhood in Georgia, where his father was president of the university located in what was then the frontier village of Athens. As a boy he spent several weeks living with a neighboring tribe of Indians. In 1809 he graduated from the University of Georgia and soon thereafter began the study of medicine under Dr. T. H. M. Fendall, with whom he labored for three years. In 1812-1813 he seems to have attended one course of lectures at the school of medicine now part of the University of Pennsylvania, but returned to Georgia and began to practice without waiting to graduate. Apparently it was not until 1817 that the University granted him a degree. It is uncertain whether he ever attended more than the one course of lectures at the University. In this same year he moved to Philadelphia, where he continued to practice. He began to lecture on midwifery at the University in 1830 and continued for several years. In 1841 he accepted the chair of Obstetrics and Diseases of Women at the (then) newly founded Jefferson Medical College. He was one of the many obstetricians of pre-eminence who bitterly opposed the theories of Oliver Wendell Holmes as to the infectiousness of puerperal fever. He was elected vice-president of the College of Physicians

of Philadelphia, succeeding Dr. George B. Wood, who had been made president; this office he held for seven years. He continued to teach at Jefferson until 1861, when retired from active life to his handsome estate in Delaware County. He died of apoplexy in 1865.

Mr. Samuel Simes, who presumably made the original assay of this sample of opium, was one of the most prominent Philadelphia pharmacists of his day. Born at Washington, Pa., in 1814, he graduated from the Philadelphia College of Pharmacy in 1833. After serving a year with Reeve and Smith, he started his own drug store at Twelfth and Chestnut Streets in 1834, where he continued in business for twenty years. After his retirement from pharmacy he became treasurer of the Pennsylvania Salt Manufacturing Company. A contemporary wrote of him: "In his business enterprises he was quite successful, accumulating a large fortune." He died in 1885.

#### **Description and Assay of the Opium**

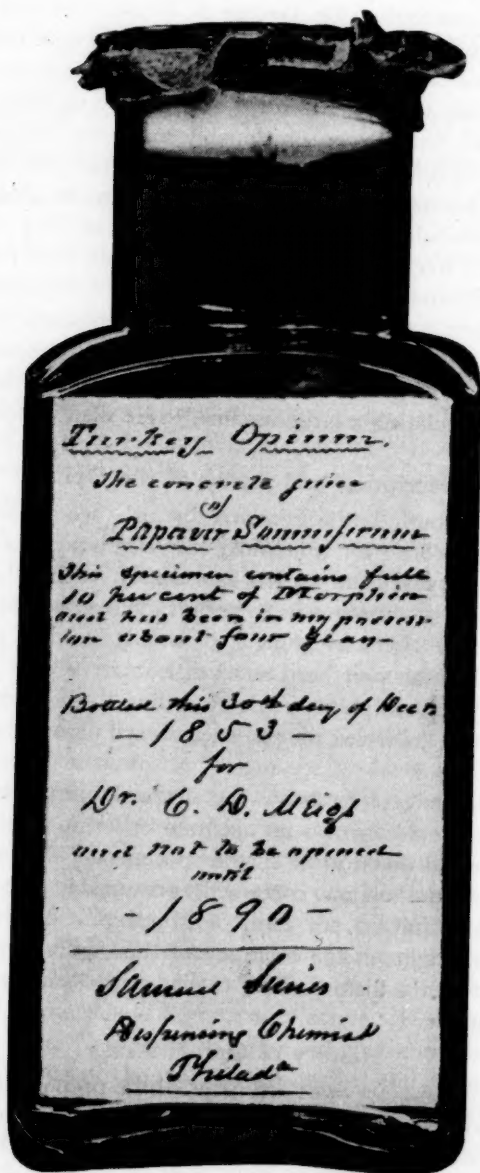
The wide-mouth bottle received by us (see illustration) was stoppered with a cork over which had been tied a piece of kid. In the course of eighty years the leather had almost entirely disintegrated and the cork had so shrunk as to permit the easy access of air. The opium was in two pieces weighing 250 gm. It had lost practically all its moisture and was very hard and brittle.

The assay for morphine, made according to the process of U. S. Pharmacopœia XI, showed the presence of 9.72 per cent. of anhydrous morphine.

Obviously unless one knew the original morphine content the present figure would furnish no accurate criterion of the amount of change which had taken place in the specimen. The label bears the statement that the opium contained, presumably when purchased by Mr. Simes, "full 10 per cent. of Morphia." With the view of throwing some light on the accuracy of this figure, we have delved considerably into the history of the earlier methods of morphinometric determinations.

#### **History of Opium Assay**

Although some previous estimates of the proportion of morphine in opium had been made the first to suggest a method of assaying opium as a criterion of its medicinal quality, which we have been able to find, was that of a pharmacist of Lyons named Guillermond in 1828. His method was briefly as follows: The opium as finely com-



Photograph of Container and Label of  
 Sample of Opium

minuted as possible, was macerated for three days in alcohol of "30 degrees" (about 75 per cent.) using four times as much alcohol as the quantity of opium. After filtration the marc was washed with another portion of alcohol. To the combined filtrates was added ammonia and the mixture allowed to stand for three days. It was then filtered and the precipitate washed with water (which removed ammonium meconate and some of the coloring matter) dried and weighed.

Regimbeau (1831) believed that the crystals obtained by Guillermond's method were largely contaminated with narcotine. He attempted to purify them by washing with hot alcohol, adding water to the filtrate until the strength of the alcohol was reduced to 14 degrees (about 17.5 per cent.) filtering and weighing the precipitate which he considered to be narcotine. He reported that the crystals yielded 47 per cent. of "narcotine." That his method of determining the proportion of narcotine was inaccurate is shown by the fact that the proportion of morphine, according to this calculation, in a sample of opium which he analyzed was only about 3.5 per cent., an almost impossibly low figure. Further, Procter many years later found that the morphine precipitated from 50 per cent. alcohol by ammonia contained 3.5 per cent. of narcotine.

In 1850 a Belgian chemist, Jean Servais Stas, in the course of a toxicological analysis, developed a method for extracting alkaloids the principle of which is still the basis of many alkaloidal assay processes. This method is based on the facts that certain salts of alkaloids are soluble in water while the bases themselves are soluble in organic solvents but not in water. This principle, however, was not applied to drug assay until many years later.

Fordos, in suggesting a new morphinometric assay in 1857, says that although the difficulties of manipulation in the Guillermond method make it hard to obtain accurate results that it was the best which had been suggested. Although Fordos's paper appeared four years after our specimen had been sealed, it may be mentioned as a matter of historical interest that he introduced the idea of making an aqueous infusion of the opium and assaying this instead of working on the crude drug.

The fact that morphine is soluble in solution of calcium hydroxide but narcotine is not—which is the basis of the present official assay process—seems to have been first applied by Mohr in 1840.

### Conclusions

From the review of the early literature on opium assay we may gather that Mr. Simes probably employed the method of Guillermond or one very similar. As this process gives too high results, it seems probable that the original morphine content of our sample was not materially lower than the 9.72 per cent. which we obtained ninety years later. We may therefore conclude that the morphine content of opium does not alter greatly under ordinary methods of storage.

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Fordos: *Journ. de Pharm.*, 1857, xxxii.  
Mohr: *Annalen der Chemie und Pharmacie* (Wöhler und Liebig), 1840, xxxv, p. 119.

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### Henry Fancied Pharmacy

Nobody seems to know just how he found the time, but Henry VIII studied pharmacy and often mixed medicines in his own laboratory as a pastime between his six love affairs. His medical knowledge, however, did not extend to obstetrics, points out Kate Campbell in "A History of Women in Medicine," recently off the Haddam Press.

Queen Catherine in eight pregnancies had only one living child. Ann Boleyn, too, had but one living child—the future Queen Elizabeth—but two miscarriages. Jane Seymour died of fever soon after her son, Edward VI, was born. He died at the age of sixteen.

Queen Mary, Catherine's daughter, was more concerned with her own health and the combating of heresy than in the health of her people. Queen Elizabeth, who had been sickly from her eleventh year, submitted to so many bleedings and purgings that it is a wonder that she lived to reign at all.

Queen Elizabeth was perhaps the most thoroughly educated woman of her age, speaking several languages, writing Latin and Greek easily, and in the meantime dabbling, like her father, in medicine.—*Hospital Topics and Buyer*, July, 1939.

## PRESERVATIVES FOR NASAL JELLIES AND OPHTHALMIC SOLUTIONS

By Louis Gershenfeld and David Tomkin

Dept. of Bacteriology, Philadelphia College of Pharmacy and Science

**A** CONSIDERATION of preservation is of importance in the manufacture of medicinal products. Bacteria, molds, and yeasts cause alterations, so that many of these products cannot be used for their intended purposes. Several processes have been devised to eliminate their contamination. They can be classified as physical or chemical. The physical methods employ the use of heat and filtration. The latter cannot be employed under all circumstances. Chemicals as preservatives are the agents of choice wherever possible. An ideal chemical preservative or antiseptic should have the following characteristics:

1. It must be effective against all types of micro-organisms causing decomposition.
2. It must be soluble in the concentration used.
3. It must not injure or cause objectionable staining of the tissues of the individual using the product.
4. It must not alter or change the character of the preparation.
5. The cost of the preservative should not cause a marked increase in the price of the preparation.

### 1. Nasal Jellies

(a) Procedure—A batch of nasal jelly containing 1.5 per cent. of tragacanth as a base in distilled water was prepared. The different preservatives used were dissolved in the water, the mixture placed in an electric mixer, and the tragacanth powder was added slowly. Approximately ten minutes were required to add the entire amount of tragacanth. The mixture was then agitated for an additional fifteen minutes until a fine running jelly was produced. The jellies containing the individual preservatives were placed in nine different one-ounce squat opal jars. The first two jars were inoculated with *E. coli* and *B. subtilis* respectively. The next five jars were inoculated with four molds and one yeast, isolated at the Smith, Kline & French laboratories, and at one of the laboratories of the Philadelphia College

of Pharmacy and Science. The medium used for isolation was Sabouraud's Agar. The fungi isolated and used for inoculation were members of the following groups:

R .....	Rhizopus
P .....	Penicillium
M .....	Mucor
F .....	Fusarium
Y .....	Pink Yeast

The inoculations were made on December 22 and 23, 1938, and observed for visible growth until May 11, 1939. This is designated as Series No. 1.

The ninth jar was filled with the jelly containing the individual preservatives without adding organisms. This was exposed to the atmosphere for one-half hour each day and the appearance of visible growth was noted. Observations began December 23, 1938, and continued until May 11, 1939. This is designated as Series No. 2.

The third series consisted in filling collapsible tubes with the jelly containing the individual preservatives, without adding organisms. The physical characteristics and bacterial contents were noted at the end of a four months' period.

The fourth series consisted in making sub-cultures of the contents in the jars of Series No. 1 after four and one-half months, to determine if the preservatives displayed bactericidal properties.

The following chemicals were used:

1. Benzoic Acid	}	1.5%
Boric Acid		0.5%
2. Methyl Hydroxy Benzoate of Sodium		0.15%
3. Ethyl Hydroxy Benzoate of Sodium		0.05%
4. Propyl Hydroxy Benzoate of Sodium		0.03%
5. Copper Sulphate		0.1%
6. Thymol		0.15%
7. Mercuraphen		0.05%
8. Chlorthymol (sat. sol.)	I:10,000	
9. Oxyquinoline Sulphate		0.1%
10. Mercuric Chloride		0.01%
11. Formaldehyde		0.2%
12. Hexylresorcinol	I:3000	
13. Metaphen	I:10,000	
14. Azochloramid	I:10,000	
15. Sodium Silico Fluoride		0.1%

16. Betanaphthol	1:1000	0.01%
17. Methyl Violet		0.02%
18. Mercarboline		0.01%
19. Merthiolate		0.01%
20. Synthetic Camphor	1:1000	0.1%
21. Sodium Salicylate		1%
22. H <sub>2</sub> O <sub>2</sub>		1.5%
23. Boric Acid	}	0.5%
Sodium Benzoate		0.02%
24. Butoben		0.01%
25. Malachite Green		0.02%
26. Acriflavine		0.001%
27. Iodine		0.005%
29. Salicyl Anilide (sat. sol.)		0.01%
30. Phenyl Mercuric Nitrate	}	0.002%
31. Phenyl Mercuric Acetate		0.01%
		0.002%
32. Phenyl Hydroxy Mercuric Chloride		0.002%
33. Chlorbutanol		0.5%

## SERIES NO. I

In this series the jars (the contents of which were inoculated) were observed for visible growth over a period of four and one-half months.

+ .... Growth	C .... E. Coli	R .... Rhizopus
— .... No growth	S .... B. Subtilis	P .... Penicillium
	Y .... Pink Yeast	M .... Mucor
		F .... Fusarium

Preservatives and Concentrations	Control	C	S	Y	R	P	M	F	Important Physical Characteristics
1.5% Tragacanth	+	+	+	+	+	+	+	+	Liquefaction
Benzoic Acid 0.5% Boric Acid 1.5%	—	—	—	—	—	—	—	—	Scum, no odor
Methyl Hydroxy Benzoate of Sodium 0.15%	—	—	+	—	+	—	—	—	Benzoic odor
Ethyl Hydroxy Benzoate of Sodium 0.05%	—	—	—	—	—	—	—	—	No odor
Propyl Hydroxy Benzoate of Sodium 0.03%	—	—	—	+	—	—	—	—	No odor
Copper Sulphate 0.1%	—	—	—	—	—	—	—	—	No odor Faint blue color

## SERIES No. 1—Continued

+ .... Growth  
 — .... No growth

C .... E. Coli  
 S .... B. Subtilis  
 Y .... Pink Yeast

R .... Rhizopus  
 P .... Penicillium  
 M .... Mucor  
 F .... Fusarium

Preservatives and Concentrations	Con- trol	C	S	Y	R	P	M	F	Important Physical Characteristics
Thymol	0.15%	—	—	—	—	—	—	—	Perceptible odor
Mercurphen	0.05%	—	—	—	—	—	—	—	Chemical scum, no odor
Chlorthymol (Sat. Sol.)	1:10,000	—	—	—	—	—	—	—	Definite odor
Oxyquinoline Sulphate	0.1%	—	—	—	—	—	—	—	No odor Yellow jelly
Mercuric Chloride	0.01%	—	—	—	—	—	—	—	No odor
Formaldehyde	0.2%	—	—	—	—	—	—	—	No odor
Hexylresorcinol	1:3000	—	—	—	—	—	—	—	No odor
Metaphen	0.01%	—	—	—	—	+	—	—	Color deepens upon standing, no odor
Azochloramid	0.01%	+	—	—	+	+	—	—	Slight yellow color
Sodium Silico Fluoride	0.1%	—	—	—	—	—	—	—	No odor
Betanaphthol (Sat. Sol.)	0.1%	—	—	—	—	—	—	—	Slight odor
Methyl Violet	0.01%	—	—	—	—	—	—	—	Deep purple color
Mercarbolid	0.02%	—	—	—	—	—	—	—	Orange color, no odor
Merthiolate	0.01%	—	—	—	—	—	—	—	No odor
Synthetic Camphor	0.1%	—	—	+	—	—	+	—	Camphor odor
Sodium Salicylate	0.1%	+	+	+	+	+	+	+	
Hydrogen Peroxide	1%	+	+	+	—	—	+	+	Liquefaction
Boric Acid Sodium Benzoate	1.5% 0.5%	—	—	—	—	+	—	—	Benzoic odor
Butoben	0.02%	—	—	—	—	—	—	—	No odor
Malachite Green	0.01%	+	+	—	—	+	+	—	No odor. Blue color
Acriflavine	0.02%	—	—	—	—	—	—	—	No odor. Yellow color
Iodine	0.001%	+	+	+	+	+	+	+	

The following were inoculated February 7, 1939, and observations were recorded on May 11, 1939:

Preservatives and Concentrations	Control	C	S	Y	R	P	M	F	Important Physical Characteristics
Salicyl Anilide (Sat. Sol.) 0.005%	—	+	+	+	+	+	—	—	No odor
Phenyl Mercuric Acetate 0.01%	—	—	—	—	—	—	—	—	No odor
Phenyl Mercuric Acetate 0.002%	—	—	—	—	—	—	—	—	No odor
Chlorbutanol 0.5%	—	—	—	—	—	—	—	—	Slight odor
Phenyl Hydroxy Mercuric Chloride 0.002%	—	+	—	+	+	+	+	+	
Phenyl Mercuric Nitrate 0.01%	—	—	—	—	—	—	—	—	No odor
Phenyl Mercuric Nitrate 0.002%	—	—	—	—	—	—	—	—	No odor

#### SERIES NO. 2

In Series No. 2 the contents in the jars were exposed one-half hour each day for four and one-half months.

+ .... Growth

— .... No growth

Preservatives		Visible Growth	Physical Characteristics
Benzoic Acid 0.5%	}	—	No odor Scum
Boric Acid 1.5%			
Methyl Hydroxy Benzoate of Sodium 0.15%		—	Benzoic odor
Ethyl Hydroxy Benzoate of Sodium 0.05%		—	Benzoic odor
Propyl Hydroxy Benzoate of Sodium 0.03%		—	No odor
Copper Sulphate 0.1%		—	No odor, light-blue color
Thymol 0.15%		—	Thymol odor
Mercurophen 0.05%		—	Chemical scum—no odor
Chlorthymol (Sat. Sol.) 0.01%		—	Thymol odor
Oxyquinoline Sulphate 0.1%		—	Slight yellow color, no odor
Mercuric Chloride 0.01%		—	No odor
Formaldehyde 0.2%		—	No odor
Hexylresorcinol 1:3000		—	No odor

## SERIES No. 2—Continued

Preservatives		Visible Growth	Physical Characteristics
Metaphen	0.01%	—	Deep color, no odor
Azochloramid	0.01%	—	Slight odor
Sodium Silico Fluoride	0.1%	+	Liquefaction
Betanaphthol (Sat. Sol.)	0.1%	—	Slight Color
Methyl Violet	0.01%	—	Deep purple color, no odor
Mercarbolid	0.02%	—	Deep color, no odor
Merthiolate	0.01%	—	No odor
Synthetic Camphor	0.1%	+	Camphor odor
Sodium Salicylate	0.1%	+	Liquefaction
Hydrogen Peroxide	1%	+	Liquefaction
Boric Acid Sodium Benzoate	1.5% 0.5%	—	No odor
Butoben	0.02%	—	No odor
Malachite Green	0.01%	+	Blue color, no odor
Acridine	0.02%	—	Deep yellow color, no odor
Iodine	0.001%	+	Liquefaction
Tragacanth Control	1.5%	+	Liquefaction

The following were exposed February 7, 1939, and observations were recorded on May 11, 1939:

Salicyl Anilide (Sat. Sol.)	0.005%	+	Liquefaction, no odor
Phenyl Mercuric Acetate	0.01%	—	No odor
Phenyl Mercuric Acetate	0.002%	—	No odor
Chlorbutanol	0.5%	—	Slight odor
Phenyl Hydroxy Mercuric Chloride	0.002%	+	No odor
Phenyl Mercuric Nitrate	0.01%	—	No odor
Phenyl Mercuric Nitrate	0.002%	—	No odor

## SERIES NO. 3

In Series No. 3 the jellies were stored in collapsible tubes. Each tube was cut open and visible growth was observed. Physical characteristics were noted and transplants on broth and Sabouraud's Agar were made. The tubes were filled on December 23, 1938, and transplants were made on April 19, 1939.

+ .... Growth  
- .... No growth

Preservatives		Visible Growth	Trans-plant on Broth	Trans-plant on Sabouraud's Agar	Physical Characteristics
Tragacanth Control	1.5%	+	+	+	Odor—Liquefaction
Benzoic Acid	0.5% }	—	—	—	No odor Scum (Chemical)
Boric Acid	1.5%				
Methyl Hydroxy Benzoate of Sodium	0.15%	—	—	—	No odor Clear jelly
Ethyl Hydroxy Benzoate of Sodium	0.05%	—	—	—	No odor Clear jelly
Propyl Hydroxy Benzoate of Sodium	0.03%	—	+	+	No odor Clear jelly
Copper Sulphate	0.1%	—	—	—	No odor Attacks metal
Thymol	0.15%	—	—	—	Thymol odor Clear jelly
Mercuraphen	0.05%	—	—	—	No odor Scum (Chemical)
Chlorthymol (Sat. Sol.)	0.01%	—	+	—	Thymol odor Clear jelly
Oxyquinoline Sulphate	0.1%	—	—	—	No odor—Yellow jelly
Mercuric Chloride	0.01%	—	—	+	No odor—Clear jelly
Formaldehyde	0.2%	—	—	—	No odor—Clear jelly
Hexylresorcinol	1:3000	—	—	—	No odor—Clear jelly
Metaphen	0.01%	—	—	—	No odor Orange jelly
Azochloramid	0.01%	—	—	—	Slight odor Yellow jelly
Sodium Silico Fluoride	0.1%	+	+	+	Odor—Growth

## SERIES No. 3—Continued

Preservatives		Visible Growth	Trans-plant on Broth	Trans-plant on Sabouraud's Agar	Physical Characteristics
Betanaphthol (Sat. Sol.)	0.1%	—	—	—	Slight odor Clear jelly
Methyl Violet	0.01%	—	—	—	No odor—Purple jelly
Mercarboline	0.02%	—	—	—	No odor Orange jelly
Merthiolate	0.01%	—	—	—	No odor—Clear jelly
Synthetic Camphor	0.1%	—	—	+	Camphor odor Clear jelly
Sodium Salicylate	0.1%	+	+	+	Odor—Growth
Hydrogen Peroxide	1%	+	+	+	Liquefaction
Boric Acid Sodium Benzoate	1.5% } 0.5% }	—	—	—	Slight odor Clear jelly
Butoben	0.02%	—	—	—	No odor—Clear jelly
Malachite Green	0.01%	+	+	+	Growth—Blue jelly
Acridine	0.02%	—	+	—	Yellow jelly
Iodine	0.001%	+	+	+	Growth—Liquefaction

The following were prepared on February 7, 1939, and observations were recorded on May 11, 1939:

Salicyl Anilide (Sat. Sol.)	0.005%	—	—	—	No odor—Clear jelly
Phenyl Mercuric Acetate	0.01%	—	—	—	No odor—Clear jelly
Phenyl Mercuric Acetate	0.002%	—	—	—	No odor—Clear jelly
Chlorbutanol	0.5%	—	—	—	Slight chlorine odor
Phenyl Hydroxy Mercuric Chloride	0.002%	+	+	+	Liquefaction
Phenyl Mercuric Nitrate	0.01%	—	—	—	No odor—Clear jelly
Phenyl Mercuric Nitrate	0.002%	—	—	—	No odor—Clear jelly

## SERIES No. 4

Series showing Bactericidal property of Preservatives inoculated with

C .... E. Coli  
S .... B. Subtilis  
Y .... Pink Yeast

R .... Rhizopus  
P .... Penicillium  
M .... Mucor  
F .... Fusarium

Transplanted after four and a half months.

Preservatives and Concentrations		Con- trol	C	S	Y	R	P	M	F
Benzoic Acid	0.5%	}	—	—	—	—	—	—	—
Boric Acid	1.5%		—	—	—	—	—	—	—
Methyl Hydroxy Benzoate of Sodium	0.15%		+	—	+	—	+	—	—
Ethyl Hydroxy Benzoate of Sodium	0.05%		—	—	—	—	—	—	—
Propyl Hydroxy Benzoate of Sodium	0.03%		—	—	+	+	—	—	—
Copper Sulphate	0.1%		+	+	+	+	+	—	—
Thymol	0.15%		+	+	+	—	+	+	+
Mercuraphen	0.05%		—	—	—	—	—	—	—
Chlorthymol (Sat. Sol.)	0.01%		—	—	+	+	—	—	+
Oxyquinoline Sulphate	0.1%		—	—	—	—	—	—	—
Mercuric Chloride	0.01%		—	—	—	—	+	—	—
Formaldehyde	0.2%		—	—	—	—	—	—	—
Hexylresorcinol	1:3000		—	—	—	—	—	—	—
Metaphen	0.01%		—	—	—	—	+	—	—
Azochloramid	0.01%		—	—	—	—	—	—	—
Sodium Silico Fluoride	0.1%		+	+	—	+	+	+	—
Betanaphthol (Sat. Sol.)	0.1%		—	—	—	—	—	—	—
Methyl Violet	0.01%		—	—	—	—	—	—	—
Mercarboline	0.02%		—	—	—	—	—	—	—
Merthiolate	0.01%		—	—	—	—	—	—	—
Synthetic Camphor	0.1%		—	—	+	+	+	+	+

## SERIES. No. 4—Continued

C .... E. Coli	R .... Rhizopus
S .... B. Subtilis	P .... Penicillium
Y .... Pink Yeast	M .... Mucor
	F .... Fusarium

Preservatives and Concentrations.		Control	C	S	Y	R	P	M	F
Sodium Salicylate	0.1%	+	+	+	+	+	+	+	+
Hydrogen Peroxide	1%	+	+	+	—	—	—	+	+
Boric Acid	1.5%	{	—	—	—	—	—	+	—
Sodium Benzoate	0.5%								
Butoben	0.02%	+	+	+	—	—	—	—	+
Malachite Green	0.01%	+	+	+	+	+	+	+	—
Acriflavine	0.02%	—	+	+	+	+	+	—	+
Iodine	0.001%	—	+	+	—	+	+	+	+

The following were inoculated on February 7, 1939, and observations were recorded on May 11, 1939:

Salicyl Anilide (Sat. Sol.)	0.005%	—	+	+	+	+	+	—	—
Phenyl Mercuric Acetate	0.01%	—	—	—	—	—	—	—	—
Phenyl Mercuric Acetate	0.002%	—	—	—	—	—	—	—	—
Chlorbutanol	0.5%	—	—	—	—	—	—	—	—
Phenyl Hydroxy Mercuric Chloride	0.002%	+	+	+	+	+	+	+	+
Phenyl Mercuric Nitrate	0.01%	—	—	—	—	—	—	—	—
Phenyl Mercuric Nitrate	0.002%	—	—	—	—	—	—	—	—

*Findings*

Most mucilages are thick, viscid, adhesive liquids, and are all prone to decomposition. They should never be made in large quantities unless a preservative is added. This is especially true of jellies made with tragacanth as the base. The following were found satisfactory and efficient as bacteriostatic agents: Ethyl Hydroxy Benzoate of Sodium (0.05%); Copper Sulphate (0.1%), Oxyquinoline Sulphate (0.1%), Mercuric Chloride (0.01%), Formaldehyde

(0.02%), Hexylresorcinol (1:3000), Azochloramid (0.01%), Betanaphthol (0.1%), Merthiolate (0.01%), Butoben (0.02%), Phenyl Mercuric Acetate (0.002%), Phenyl Mercuric Nitrate (0.002%), and Chlorbutanol (0.5%). Thymol (0.15%), Chlorthymol (0.01%), Metaphen (0.01%), Methyl Violet (0.01%), Mercarbolid (0.02%), Acriflavine (0.02%) are effective, but the odor or color may mitigate against their use. The following were not found satisfactory, due to the fact that they do not prevent growth, or that the preservatives are incompatible with tragacanth: Mercuraphen (0.05%), Sodium Silico Fluoride (0.1%), Synthetic Camphor (0.1%), Sodium Salicylate (0.1%), Hydrogen Peroxide (1%), Malachite Green (0.02%), Iodine (0.001%), Salicyl Anilide (0.005%), and Phenyl Hydroxy Mercuric Chloride (0.002%).

In the final series we were interested in determining the bactericidal power of the preservatives after almost four and one-half months' contact. The following jellies, which do not display objectionable features as color, odor, metallic scum or other incompatibilities, are also bactericidal: Ethyl Hydroxy Benzoate of Sodium (0.05%), Oxiquinoline Sulphate (0.1%), Formaldehyde (0.2%), Hexylresorcinol (1:3000), Azochloramid (0.01%), Betanaphthol (0.1%), Merthiolate (1:10,000), Phenyl Mercuric Nitrate (0.002%), Phenyl Mercuric Acetate (0.002%), and Chlorbutanol (0.5%).

## 2. Ophthalmic Solutions

Yeast and fungi grow in most ophthalmic solutions unless some preservative is added. A 2 per cent. boric acid solution usually prevents fungal and bacterial growth if ordinary precautions are observed. Every now and then the manufacturer or pharmacist, however, finds that the ophthalmic solutions become moldy, especially if such solutions are kept for long periods of time. The following investigation was accordingly made.

Procedure: The basic solution prepared consisted of 2 per cent. Boric Acid, 1 per cent. Therapeutic Agent (Paredrine Hydrobromide), Distilled Water, and the individual Preservatives. The different preservatives were dissolved in Water and the Boric Acid and Paredrine Hydrobromide were added; 500 cc. volumes were made in each batch. Ten (10) cc. of each individual batch were placed in sterile test tubes. Each tube was inoculated separately with *E. coli*; *B. subtilis*; Pink Yeast; (F1)—*Rhizopus*; (F2)—*Penicil-*

lium; (F3)—Mucor; (F4) and (F5)—Fusarium. Fusarium F5 was isolated from an ophthalmic solution at the S. K. F. laboratories. The tubes were inoculated with the respective organisms on February 5, 1939. Sub-cultures were made on February 11, Feb. 25, and on March 11. The transplants were observed until and the findings were recorded on May 11, 1939. The molds and yeast were transplanted on Sabouraud's Agar and the other bacteria were transplanted in broth. Controls were run on tubes without organisms, using a 2 per cent. Boric Acid control and one containing only 1 per cent. Parendrine Hydrobromide.

SERIES CONTAINING 2% BORIC ACID, 1% THERAPEUTIC AGENT (PAREDRINE HYDROBROMIDE), PRESERVATIVE, AND DISTILLED WATER

C .... Control	F1 .... Rhizopus
B1 .... E. Coli	F2 .... Penicillium
B2 .... B. Subtilis	F3 .... Mucor
Y .... Pink Yeast	F4 .... Fusarium (Pink)
	F5 .... Fusarium (Purple)

Observed to May 11th

Inoculated Feb. 5, 1939	Transplanted 2-11-39; Growth in the following	Transplanted 2-25-39; Growth in the following	Transplanted 3-11-39; Growth in the following
Methyl Hydroxy Benzoate of Sodium (Sat. Sol.) 0.15%	F2, F5	F2	No growth
Ethyl Hydroxy Benzoate of Sodium 0.05%	F2	No growth	No growth
Propyl Hydroxy Benzoate of Sodium 0.05%	F2	No growth	No growth
Sodium Benzoate 0.1%	F1, F2	F2	No growth
Sodium Benzoate 0.5%	F1, F2	No growth	No growth
Acriflavine 0.01%	F1, F2	F2	No growth
Chlorbutanol 0.5%	No growth	No growth	No growth
Chlorthymol (Sat. Sol.) 0.01%	No growth	No growth	No growth
Synthetic Camphor 0.01%	F1, F2, F3, F5, Y, C	F2	F2
Synthetic Camphor 0.1%	F1, F2, F5, C	F2	No growth

SERIES CONTAINING 2% BORIC ACID, 1% THERAPEUTIC AGENT (PAREDRI  
HYDROBROMIDE), PRESERVATIVE, AND DISTILLED WATER—Continued

C .... Control	F1 .... Rhizopus
B1 .... E. Coli	F2 .... Penicillium
B2 .... B. Subtilis	F3 .... Mucor
Y .... Pink Yeast	F4 .... Fusarium (Pink)
	F5 .... Fusarium (Purple)

Observed to May 11th

Inoculated Feb. 5, 1939		Transplanted 2-11-39; Growth in the following	Transplanted 2-25-39; Growth in the following	Transplanted 3-11-39; Growth in the following
Butoben	0.02%	F1, F2, Y, C	No growth	No growth
Merthiolate	0.01%	No growth	No growth	No growth
Oxyquinoline Sulphate	0.1%	F2	No growth	No growth
Oxyquinoline Sulphate	0.05%	F2	No growth	No growth
Mercuriofen	0.01%	F2	No growth	No growth
Phenyl Hydroxy Mercuric Chloride	0.002%	F1, F2, Y, C	F1, F2, C	F2
Phenyl Hydroxy Mercuric Chloride (Sat. Sol.)		F2	F2	No growth
Phenyl Mercuric Acetate	0.01%	No growth	No growth	No growth
Phenyl Mercuric Acetate	0.002%	No growth	No growth	No growth
Phenyl Mercuric Nitrate	0.01%	No growth	No growth	No growth
Phenyl Mercuric Nitrate	0.002%	No growth	No growth	No growth
Collargolum	0.1%	F1, F2, F5	No growth	No growth
Copper Sulphate	0.01%	F1, F2, F5, Y, C	F1	No growth
Boric Acid Control	2%	F1, F2, F4, F5, C	F1, F2, F5, C	F1, F2, F5
Paredrine Hydrobromide Control	1%	F1, F2, F3, F4, F5, C	F1, F2, F3, F4, F5, C	F1, F2, F4, F5

*Findings*

Chlorbutanol (0.5%), Chlorthymol (0.01%), Merthiolate (0.01%), Phenyl Mercuric Acetate (0.002%), Phenyl Mercuric Nitrate (0.002%) are effective as bactericidal agents within a period of six days. Ethyl (0.05%) and Propyl (0.05%) esters of Hydroxy Benzoate of Sodium, Sodium Benzoate (0.5%), Butoben (0.02%), Oxyquinoline Sulphate (0.05%), Mercurophen (0.01%) and Collargolum (0.1%) were effective after twenty days. Methyl Hydroxy Benzoate of Sodium (0.15%), Sodium Benzoate (0.1%), Acrilavine (0.01%), Synthetic Camphor (0.1%), and Phenyl Hydroxy Mercuric Chloride (sat. sol.) and Copper Sulphate (0.01%) kill after thirty-five days' contact. *B. subtilis* and *E. coli* do not grow in any of these solutions, because the low pH of the latter prevents their growth.

The lists which follow concern themselves with the bacteriostatic or bactericidal efficiency of the chemicals mentioned therein. Toxicity tests were not conducted nor were tests made to determine whether the chemicals displayed irritating or other objectionable properties when used in the nasal passages or in the eyes.

**Conclusions****A. Nasal Jellies**

The following preservatives displayed either bacteriostatic or bactericidal properties, did not attack the collapsible tubes, and did not possess an objectionable color, odor, or appearance after a period of four and one-half months:

		<i>Inhibitory    Bactericidal</i>	
Ethyl Hydroxy Benzoate of Sodium	0.05%	Yes	Yes
Propyl Hydroxy Benzoate of Sodium	0.03%	Yes	No
Oxyquinoline Sulphate	0.1%	Yes	Yes
Formaldehyde	0.2%	Yes	Yes
Hexylresorcinol	1:3000	Yes	Yes
Azochloramid	0.01%	Yes	Yes
Betanaphthol	0.01%	Yes	Yes
Merthiolate	0.01%	Yes	Yes
Butoben	0.02%	Yes	No
Phenyl Mercuric Acetate	0.002%	Yes	Yes
Phenyl Mercuric Nitrate	0.002%	Yes	Yes
Chlorbutanol	0.5%	Yes	Yes

## B. Ophthalmic Solutions

1. Chlorbutanol (0.5%), Chlorthymol (0.01%), Merthiolate (0.01%), Phenyl Mercuric Acetate (0.002%), and Phenyl Mercuric Nitrate (0.002%) displayed bactericidal power after six days.

2. The following displayed bactericidal properties after twenty days:

1. Ethyl Hydroxy Benzoate of Sodium	0.05%
2. Propyl " " " "	0.05%
3. Sodium Benzoate	0.5%
4. Butoben	0.02%
5. Oxyquinoline Sulphate	0.05%
6. Mercurophen (precipitates)	0.01%
7. Collargolum	0.1%

3. Methyl Hydroxy Benzoate of Sodium (0.15%), Sodium Benzoate (0.1%), Acriflavine (0.01%), Synthetic Camphor (0.1%), Phenyl Hydroxy Mercuric Chloride (sat. sol.), and Copper Sulphate, (0.01%), were bactericidal after thirty-five days.

## Acknowledgments

Grateful acknowledgment is made to Dr. R. Blythe and Mr. W. F. Thompson of the Smith, Kline & French laboratories for their cooperation in making this research possible.

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## ON THE NATURE OF THE PRECIPITATES OBTAINED BY ADDING SODIUM SILICATE TO MAGNESIUM SULFATE

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### Abstract

This introductory paper describes the preparation of a group of magnesium silicates by the interaction of sodium silicate and magnesium sulfate (moles  $\text{Na}_2\text{O}, 3.27\text{SiO}_2$ /moles  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O} = 0.51-2.03$ ). Careful analyses of the products (molecular ratios,  $\text{MgO}:\text{SiO}_2 = 1:3.08-1:4.31$ ) have furnished the data needed for plotting curves, useful in determining the proportions of reactants required to produce any silicate in the range studied.

### Introduction

From time to time, reports on studies of the reactions between sodium (or potassium) silicate and magnesium sulfate (or chloride) have appeared in the scientific literature. These studies range from such early work as that of Döbereiner, (1) von Ammon, (2) Heldt, (3) Haushofer, (4) and May, (5) down through the more recent work of Damiens, (6) Britton, (7) Joffe and co-workers, (8) Glass, (9) and others.

The aforementioned investigators were concerned with the preparation (in the wet way) and properties of a variety of magnesium silicates, although frequently the materials and the experimental procedures employed were vaguely, if at all, described.

"The assumption that even definite silicates such as sodium metasilicate will react quantitatively with metallic salts of definite composition in solution to form definite insoluble silicates will lead to serious error. Attempts to prepare metallic silicates in the wet way would never be expected to lead to simple, definite products but always to a mixture in which one or more silicates are associated to a greater or less degree with hydroxides, complex silicates, and silica." (10)

The primary purpose of the present investigation was to ascertain the extent of the variation in chemical composition of the products obtained when varying proportions of sodium silicate and magnesium sulfate are allowed to interact. Accordingly, in two series (preliminary and final) of carefully conducted experiments, solutions of

sodium silicate were added to solutions of magnesium sulfate, the proportions employed embracing the range 0.5-2.0 for moles  $\text{Na}_2\text{O} \cdot 3.3\text{SiO}_2$ /moles  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ . The precipitates so formed were freed from contaminating constituents by thorough washing, then dried, powdered, and analyzed.

The technique used in the preliminary series of three experiments (17, 29 (a), and 29 (b)) was essentially that of the final series of five experiments (1, 2, 3, 4, and 5). The following is a detailed description of the materials and the procedure employed in the latter series. See also Table 1.

### Materials

Each solution of magnesium sulfate was made by dissolving Baker's C. P. salt in thirty times its weight of water.

The sodium silicate was "E" Brand of the Philadelphia Quartz Company. It is a clarified liquid of specific gravity 1.384 (25° C.), which, upon careful analysis, was found to contain 8.86 per cent.  $\text{Na}_2\text{O}$  and 28.06 per cent.  $\text{SiO}_2$  (molecular ratio,  $\text{Na}_2\text{O}:\text{SiO}_2 = 1:3.27$ ). (11) Prior to use in the experiments, each volume of "E" Brand sodium silicate was diluted with 3.13 volumes of water, and the resulting solution was allowed to stand over night.

### Technique

To the magnesium sulfate solution, the sodium silicate solution was added slowly (5-20 minutes) from a graduate, (12) with stirring (by motor), stirring being then continued for an additional period (5 minutes) to insure thorough mixing. The precipitates were collected on "Hope" muslin supported by 1-gallon glass funnels, and were freed as completely as possible from adhering liquor by drainage; whereupon washing with distilled water was instituted and continued at least until portions of the washings showed no tests (or only extremely faint tests) for unreacted sodium silicate (with  $\text{MgSO}_4$  or  $\text{BaCl}_2$  (13)), sulfate (with  $\text{BaCl}_2$ ,  $\text{HCl}$ ), magnesium (with  $\text{NH}_4\text{Cl}$ ,  $\text{NH}_4\text{OH}$ ,  $\text{Na}_2\text{HPO}_4$ ), and sodium (with zinc uranyl acetate), ample time being allowed for the formation of any precipitates in these tests. Thus, the precipitates from experiments 1, 2, and 3 were each washed with approximately 28 liters of distilled water over a period of 13 days; while those from experiments 4 and 5 were each washed with approximately 63 liters of distilled water over a period of 26 days,

TABLE I. RÉSUMÉ OF EXPERIMENTS

Experiment *	C. P. MgSO <sub>4</sub> ·7H <sub>2</sub> O, g.	"E" Brand Sodium Silicate, cc.	Moles Na <sub>2</sub> O <sub>3.27</sub> SiO <sub>2</sub> † Moles MgSO <sub>4</sub> ·7H <sub>2</sub> O	Yield, g. ‡	Remarks
17	100.9	230.	(1.11)	117.6	Material collected and washed on cotton gauze and paper in large Buchner funnel. Tap water used throughout. Washing period = 3 days.
29 (a)	20.2	69.	(1.66)	24.2	Tap water used throughout. Washing period = 5 days.
29 (b)	40.4	46.	(0.55)	22.8	Tap water used throughout. Washing period = 4 days.
1	61.6	64.5	0.51	28.8	Distilled water used throughout.
2	61.6	96.8	0.76	45.9	Do.
3	61.6	129.0	1.02	60.6	Do.
4	61.6	193.6	1.53	61.2	Do.
5	61.6	257.5	2.03	63.0	Do.

\* All of the experiments were conducted at room temperature (approximately 24.5° C.).

† The ratios given in parentheses were obtained by assuming that the values actually found for the specific gravity (1.384, 25° C.) and the Na<sub>2</sub>O and SiO<sub>2</sub> contents (8.86 per cent. and 28.06 per cent., respectively) of the sample of "E" Brand sodium silicate used in the final series of experiments were applicable to the previously purchased and unanalyzed sample of "E" Brand employed in the preliminary series of experiments.

‡ Somewhat cloudy filtrates observed in the course of collecting and washing the precipitates, solubility effects, and slight manipulative losses resulted in a loss of some material.

these latter precipitates proving to be exceedingly resistant to purification. Throughout the washing operation the precipitates in the funnels were protected from dust by means of large watch glasses.

The precipitates were then carefully transferred from the muslin to small, porcelain-lined trays, and were dried in an electric oven set at 60-65° C. The resulting materials were pulverized in porcelain mortars, following which they were air-dried over night, weighed, and stored in cork-stoppered bottles.

### Results and Discussion

The synthetic silicates were analyzed by reliable and well-known methods, taking all of the precautions characteristic of refined quantitative analysis. The results are given in Table 2, wherein are also given, for each sample, the silica and magnesia contents on a water-free basis, as well as the molecular ratio,  $\text{MgO}:\text{SiO}_2$ .

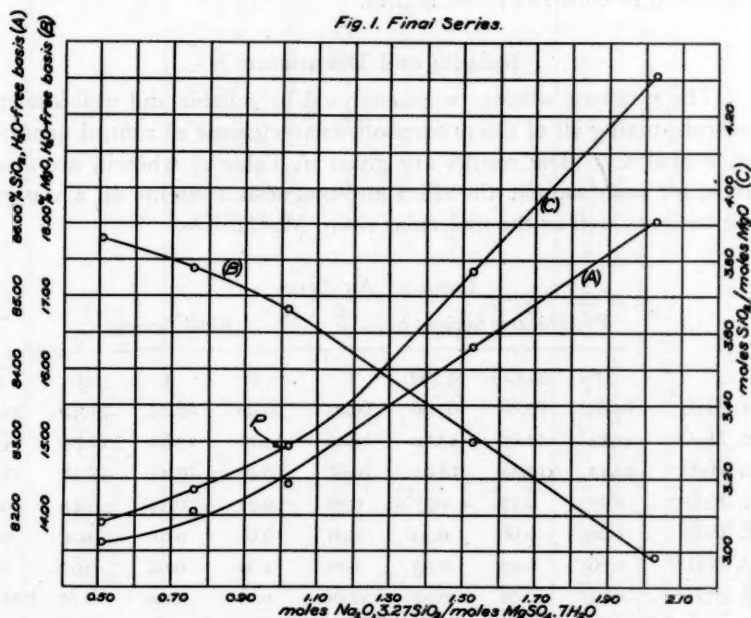
TABLE 2. ANALYSES

	Preliminary Series			Final Series				
	17	29 (a)	29 (b)	1	2	3	4	5
Per cent. $\text{SiO}_2$	65.81	69.88	67.66	66.05	66.96	68.05	71.47	72.73
Per cent. $\text{MgO}$	12.83	11.07	13.60	14.40	14.19	13.89	12.72	11.34
Per cent. $\text{H}_2\text{O}$	20.42	17.24	18.04	19.08	18.40	17.44	15.22	15.46
Per cent. $\text{R}_2\text{O}_3$	0.37	0.55	0.37	0.35	0.21	0.34	0.44	0.30
Per cent. $\text{CaO}$	0.26	0.96	0.29	0.01	0.01	0.01	0.04	0.08
Per cent. $\text{Na}_2\text{O}$	0.06	0.05	0.03	0.01	0.01	0.04	0.02	0.02
Per cent. $\text{SO}_3$	0.04	0.02	0.02	none	0.01	none	0.01	trace (0.01 %)
Per cent. Total	99.79	99.77	100.01	99.90	99.79	99.77	99.92	99.93
Per cent. $\text{SiO}_2$ , $\text{H}_2\text{O}$ -free basis	82.70	84.44	82.55	81.62	82.06	82.42	84.30	86.03
Per cent. $\text{MgO}$ , $\text{H}_2\text{O}$ -free basis	16.12	13.38	16.59	17.80	17.39	16.82	15.00	13.41
Molecular ratio, $\text{MgO}:\text{SiO}_2$	1:3.44	1:4.24	1:3.34	1:3.08	1:3.17	1:3.29	1:3.77	1:4.31

Fig. 1, depicting the effect of varying the proportions of the reacting sodium silicate and magnesium sulfate upon the chemical composition of the resulting products, in the final series of experiments, was obtained by plotting the ratios, moles  $\text{Na}_2\text{O}, 3.27\text{SiO}_2/$

moles  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$  (from Table 1), as abscissas, against the corresponding

- (A)  $\text{SiO}_2$  percentages, on a water-free basis, }  
 (B)  $\text{MgO}$  percentages, on a water-free basis, } (from Table 2)  
 and  
 (C) ratios, moles  $\text{SiO}_2$ /moles  $\text{MgO}$ , }  
 respectively, as ordinates.



From Tables 1 and 2 and Fig. 1, it will be seen that, under the conditions of the present experiments:

1. With increasing ratios of the amounts of reacting substances, moles  $\text{Na}_2\text{O}, 3.27\text{SiO}_2$ /moles  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ , the products show progressively increasing silica contents and correspondingly decreasing magnesia contents (water-free basis), with the attendant increasing ratios, moles  $\text{SiO}_2$ /moles  $\text{MgO}$ .

2. A synthetic magnesium silicate, in which the molecular ratio,  $\text{MgO}:\text{SiO}_2$ , is the same as the molecular ratio,  $\text{Na}_2\text{O}:\text{SiO}_2$ , in the sodium silicate used in its preparation (1:3.27), results from the interaction of equal numbers of moles of the sodium silicate and mag-

nesium sulfate, that is, where moles  $\text{Na}_2\text{O}, 3.27\text{SiO}_2/\text{moles MgSO}_4 \cdot 7\text{H}_2\text{O} = 1.00$  (point P, Fig. 1).

3. Thorough washing of the precipitated magnesium silicates enables one to obtain preparations that are essentially free of sodium (and sulfate), even where a considerable excess of sodium silicate has been employed as precipitant, as in experiment 5.

Furthermore, the noteworthy amounts of calcium in the products of the preliminary series of experiments, more especially experiment 29 (a), may be derived from the tap water used in these experiments (14) by base-exchange, by adsorption, and as the result of contamination by precipitated calcium silicate coming from the interaction of dissolved calcium compounds and sodium silicate.

Finally, a few words concerning yields (see column 5, Table 1) may not be amiss. If it is assumed first, that the ratio,  $\text{MgO}:\text{SiO}_2$ , in each original precipitate (15) is the same as the ratio found in the corresponding final product, (16) and second, that where moles  $\text{Na}_2\text{O}, 3.27\text{SiO}_2/\text{moles MgSO}_4 \cdot 7\text{H}_2\text{O}$  is less than 1.00, the  $\text{MgO}$  in the original precipitate is equivalent in amount to the  $\text{Na}_2\text{O}$  in the sodium silicate, and that where moles  $\text{Na}_2\text{O}, 3.27\text{SiO}_2/\text{moles MgSO}_4 \cdot 7\text{H}_2\text{O}$  is greater than 1.00, the  $\text{MgO}$  in the original precipitate is equivalent in amount to the magnesium sulfate, then simple calculations will show that the yields in experiments 1, 2, 3, 4, and 5 are, respectively, 80, 85, 84, 77, and 71 per cent. of the "theory."

### Conclusion

The effects of variations in: the composition of the sodium silicate, the concentrations of the solutions, the temperature, the method of mixing ("regular" or "reverse"), and other factors remain to be studied. The present experiments, therefore, are offered only as a modest contribution to the elucidation of this interesting, albeit complex, chemical problem.

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11. The manufacturers of this material state that it is a 40° Baumé liquid holding, according to a typical analysis,
 

8.70 per cent. $\text{Na}_2\text{O}$	0.020 per cent. $\text{CaO}$
28.06 per cent. $\text{SiO}_2$	0.042 per cent. $\text{MgO}$
0.079 per cent. $\text{Al}_2\text{O}_3$	0.035 per cent. $\text{Cl}$
0.015 per cent. $\text{Fe}_2\text{O}_3$	0.025 per cent. $\text{SO}_3$
0.036 per cent. $\text{TiO}_2$	0.038 per cent. $\text{CO}_2$

 (molecular ratio,  $\text{Na}_2\text{O}:\text{SiO}_2 = 1:3.33$ ).
12. Precipitation is immediate upon the first addition of sodium silicate solution.
13. When a day-old 1:600 (by volume) solution of "E" Brand sodium silicate in water is treated with an excess of either N/1  $\text{MgSO}_4$  or N/1  $\text{BaCl}_2$ , a gelatinous precipitate is obtained in a few minutes.
14. Baltimore tap water contains approximately 14 parts calcium per million.
15. By *original precipitate* is meant the precipitate obtained after mixing in all of the sodium silicate with the magnesium sulfate (prior to the filtration and washing operations).
16. By *final product* is meant the end product of the process—the material analyzed.

## ABSTRACTS FROM AND REVIEWS OF THE LITERATURE OF THE SCIENCES SUPPORTING PUBLIC HEALTH

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**Sulfanilamido Derivatives of Heterocyclic Amines.** R. J. Fosbinder and L. A. Walter, *J. Amer. Chem. Soc.* 61, 2032 (1939). This paper describes the preparation of some 2-sulfanilamido thiazoles and pyridines which appear to have anti-streptococcic and anti-pneumococcic power comparable to sulfanilamide and sulfapyridine respectively.

2-aminothiazole and 2-amino-4-methylthiazole were obtained by treating thiourea with dichloroethyl ether and with chloroacetone respectively.

Treatment of two moles of the heterocyclic amine with one mole of required sulfonyl chloride in ethyl acetate or dioxane solution gave the nitro and acetamino sulfonamides, as in the following:

*2-p-nitrobenzenesulfonamide-6-aminopyridine*—Obtained in 22 g. yield by adding 21.8 g. 2,6-diaminopyridine in 200 cc. ethyl acetate to 22.1 g. p-nitrobenzenesulfonyl chloride in 75 cc. of ethyl acetate; solution kept in cold water, with occasional shaking, for several hours then allowed to stand overnight at room temperature. Solvents removed on a steam-bath, the only residue being shaken with water until crystallized, filtered, recrystallized from alcohol using decolorizing charcoal. It is soluble in very dilute alkalies.

*2-sulfanilamido-6-aminopyridine*—1. 22 g. of above nitro compound was stirred with 200 g. of 10 per cent. HCl and finely divided tin; whole being kept at 50 degrees for one-half hour, filtered hot and diluted with water. Tin salt is precipitated with  $H_2S$  and the filtered solution neutralized with  $NaHCO_3$  precipitating the sulfanilamide which was then crystallized from alcohol in a 15 g. yield.

2. Acetyl group was removed from 2- $N_4$  acetylsulfanilamido-6-aminopyridine by refluxing with ten times its weight of 5-10 per cent. NaOH after repeated attempts to remove the acetyl group with acid gave chiefly sulfanilic acid.

*Sulfanilamidothiazoles*—30 per cent. yield of 2-sulfanilamido-4-methylthiazole was obtained by reduction of the nitro compound with tin and hydrochloric acid.

The acetyl group was removed, in 70 per cent. yield, by refluxing with ten times its weight of 10 per cent. HCl for one-half hour. It was found that longer periods of refluxing gave lower yields. The 2-sulfanilamido-4-methylthiazole was prepared this way. These compounds are soluble in dilute acids and in dilute alkalis.

Of the compounds prepared the following seemed to give the best results. 2-sulfanilamido-6-aminopyridine, 2-sulfanilamido-4-methylthiazole, 2-sulfanilamidothiazole.

H. G. D.

**Bactericidal Effects of Ultraviolet Radiation Produced by Low Pressure Mercury Vapor Lamps.** L. R. Koller. *J. Applied Physics*, 10, 624 (1939). The killing effect of the 2537 Angstrom radiation (ultraviolet) was studied for both bacteria suspended in air, and bacteria and molds on surfaces. The radiation was produced by a 15-watt, low pressure, mercury vapor lamp using glass of high transmission for the ultraviolet region.

Most of the work was done on *B. Coli Communis*, although some measurements were made on *B. Prodigiosus* and *B. Subtilis*. The bacteria were plated in agar, incubated at body temperatures, and otherwise treated according to standard bacteriological practice. In petri dishes in which no colonies appeared it was assumed that a lethal dose of ultraviolet had been administered. In other cases the number of colonies could be counted and compared against the control, to test the killing action.

It was found that when the 15-watt lamp was operated 10 seconds that 97 per cent. to 99 per cent. of *B. Coli* suspended in air at 24 inches were killed. This required 25 micro-watts per sq. cm. while to produce a lethal dose in agar required 6600 micro-watts per sq. cm. Black mold required 45 times this amount to produce sterility. The effectiveness of the ultraviolet light was found to be greatly reduced by the slight shielding afforded by a thin film of grease.

The chief usefulness of this lamp lies in its ability to sterilize air at low cost. In an air duct the lamp can sterilize 200 cu. ft. per minute. This makes it useful for sterilizing air in the ducts of ventilating and air conditioning systems such as those used in hospitals, theaters, homes, auditoriums, and schools. It might be used also in refrigerators, or in rooms where sterile products are being prepared or packaged. However since direct radiation from the lamp is harmful to the eyes, and should not be allowed to fall on the skin for long periods of time, workers should be properly protected.

D. P. L.

**An Investigation as to the Possibility of Deleterious Effects Using Soap Substitutes in Dentifrices.** S. Epstein, A. H. Thronson, W. Dock & M. L. Tainter, *J. A. D. A.*, 26, 1461 (1939). During the last few years a considerable number of cosmetic and toilet preparations have been introduced containing new chemical substitutes for soap as detergent materials. These overcome certain of the disadvantages of soap, e. g., they are not precipitated by calcium and do not possess its high alkalinity. The most promising substitutes are the alkyl sulfates. If these are to be used in dentifrices it is imperative to consider not only their cleansing properties but also their potential injurious and toxic effects. This seems to have been overlooked considering the dearth of references relative to possible health hazards from the indiscriminate use of these agents. Kitchin and Graham (*J. A. D. A.* 24, 736 (1937)) found that no irritation of the oral mucous membranes was produced by these agents but no findings were reported on the problem of whether daily swallowing of small amounts of these materials over long periods, as in their use as dentifrices, might result in manifestations of chronic or acute poisoning. Neither was any report made on the question whether acute irritant or toxic effects might occur from accidental swallowing of large quantities of dentifrices by children or incompetent persons.

The authors using sodium lauryl sulfate (Irium) which is present in Pepsodent Tooth Paste (0.31 per cent.), Pepsodent Tooth Powder (1.25 per cent.) and Teel (2 per cent.) and sodium lauryl sulfoacetate (Lusterfoam) which is present in Listerine Tooth Powder (2.5 per cent.) and Listerine Tooth Paste (1.25 per cent.) investigated the properties of these substances from the standpoint of acute and chronic toxicity. Their findings are condensed as follows:

1. Both were found to be irritating to the nose when inhaled in the powdered state. In rabbits they produced extensive conjunctivities similar to but more intense than that produced by soap.
2. Injected subcutaneously in white rats they cause local inflammatory changes including swelling and sloughing of the tissues, the local reactions being more marked than those from soap.
3. The acute systemic toxicity of the two substitutes appears to be negligible since it was not possible to regularly kill white rats by the intravenous injections of large volumes of the strongest solutions possible. The few fatalities observed were ascribed to ana-

phylactoid reactions rather than to intrinsic systemic actions of the agents. Intraperitoneally the agents were about four times as toxic as soap.

4. Rats taking sodium alkyl sulfate or soap in the drinking water continuously for months sustained an impairment of appetite with consequent decrease in food intake and body weight. The concentrations of the agents having these effects were high i. e., 5 per cent. soap and 0.25 per cent. or more of sodium alkyl sulfate. The effect of these substances is not, however, out of proportion to their greater detergent efficiency considering the concentrations commonly used.

5. Whereas the experimental results indicate the comparative innocuousness of these soap substitutes and certain advantages appear obvious, time and human experience will best tell whether their continued use in dentifrices is justified. Some deleterious and undesirable effects experienced by the public in other fields indicate a failure to realize that much lower concentrations must be used than when soap is employed.

L. F. T.

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**Antioxidants for Castor Oil.** G. O. Inman. *J. Ind. & Eng. Chem.* 31, 1103 (1939). Castor Oil as a lubricant in ordnance matériel has proved very advantageous in certain instances since it can be used in contact with rubber packings with no harmful effects on the latter. A disadvantage frequently encountered, however, is that with age the castor oil becomes oxidized, attacks brass parts and causes undesirable corrosion. It is not uncommon for castor oil which has been applied to a lubricator of a mechanism in storage to increase in acidity from a value of 2 to above 35 in two years. The green color which develops in the oil on the lubricators is evidence of such corrosion. These brass parts are attacked more rapidly by castor oil of high acidity than by an oil of low acidity. The work reported was done with the hope of finding an inhibitor which would prevent the oxidation of castor oil. Yamaguchi subjected olive oil and castor oil to oxidation and followed the reaction by the change in iodine number. He found that minute amounts of diphenylhydrazine greatly prolonged the latent period and that the length of the latent period was approximately proportional to the diphenylhydrazine added. Considerable work has been done by Tanaka and

Nakamura on antioxidants of classes of oils such as linseed, soybean, cottonseed and others. Phenols were arranged according to their antioxygenic activity as follows: pyrogallol, hydroquinone, catechol, anhydrous phloroglucinol, resorcinol, phloroglucinol dihydrate and phenol. With nitro and chlorophenol the activity depends upon the position of the substituent group or atom. Mattill studied the rate of oxygen absorption by a standard mixture of lard and cod liver oil in the presence of various aromatic hydroxyl derivatives. He observed that if there are two hydroxyl groups in the ortho or para position the antioxygenic activity is high whereas the meta compounds are inactive and that alphanaphthol is much more effective than the beta derivative.

The work reported in this paper was a study of the antioxygenic activity of various compounds towards castor oil the results being measured by following the rise in the acidity of the oil. The reaction was accelerated by passing oxygen through the oil held at an elevated temperature. Using 0.1 per cent. of the antioxidant the order of effectiveness was as follows:

- Pyrogallol
- Hydroquinone
- Catechol
- 8-Hydroxyquinoline
- $\alpha$ -Naphthol
- Morpholine
- Phenyl  $\alpha$  naphthylamine
- Diphenyl sulfide
- Diamylamine
- Control Sample*
- Glycine
- Benzyl alcohol
- Resorcinol
- p-Nitrophenol
- o-Cresol
- p-Cresol
- Thymol
- o-Nitrophenol
- m-Cresol
- Thio- $\beta$ -naphthol
- p-Thiocresol

It is seen that those substances listed after the control sample actually behave as pro-oxidants. L. F. T.

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**The Treatment and Prevention of Ivy Poisoning.** J. C. Attix and J. C. Rommel, *Clin. Med. & Surg.* 46, 410 (1939). Although papers on the subject accredit Schamberg (*J. A. M. A.* 73, 1213 (1919)) with first using tincture of rhus tox. internally for immunization against ivy poisoning Attix published a description of such treatment in the *Medical World* in 1912.

Many substances are recommended for local application in the treatment of rhus eruptions e. g., copper sulfate, sodium carbonate, zinc sulfate, sodium chloride, etc. Calamine either as a powder to be dusted on or suspended in water is highly recommended by many. Sodium thiosulfate is a favorite remedy with many, used in aqueous solution of from  $\frac{1}{2}$ -1 dram to the fluidounce. Lead water and laudanum is still a favorite remedy with many. It seems to allay the irritation more quickly than most of the other applications used. The formula most frequently used is 4 parts of solution of lead subacetate, 16 parts of water and 1 part of Tincture opium. Spirit of ethyl-nitrite is often used and it seems serviceable probably due to the alcohol which it contains. Attix has found a combination of sodium thiosulfate ( $\frac{1}{2}$ -1 dram to the ounce) with lead water and laudanum very effective in most cases.

Since rhus inflammation is an auto-inoculable disease and one where the various solutions are applied on gauze the parts should be as thoroughly cleansed as possible and the dressings removed and new ones applied daily or oftener.

In many cases the extract of *grindelia robusta* acts almost as a specific. The fluidextract is diluted with 10-15 parts of water and either mopped on frequently or gauze saturated with it as applied to the parts and kept wet. It is of interest to note that *Rhus toxicodendron* and *grindelia robusta* grow side by side in certain localities, an example of nature supplying the poison and its antidote in the same place.

Attix reports excellent results giving rhus tox. internally in the prevention of rhus poisoning. One dram of the Tr. is used per 4 fluidounces of water or elixir lactated pepsin and a dose of one teaspoonful well diluted is prescribed to be taken before each meal. Children should take 10-15 drops three times a day. L. F. T.

**Tannic Acid Gauze.** R. M. Savage and W. P. Chambers. *Pharm. J.* 89, 105 (1939). Tannic acid is now firmly established as an external application in burn therapy. Exclusion of micro-organisms from an aqueous solution of tannic acid will cause it to remain stable. To insure this and to prohibit infection of the wound, the addition of antiseptics has been suggested.

Dry tannic acid, impregnated on gauze is not so stable as are aqueous solutions. The surface area of the former exposed to the air is greater and more easily accessible. The author suggests the advisable employment of air-tight containers. Tannic acid may possibly be converted into gallic acid, and a valuable gauze may have been rejected on the basis of chemical tests despite the fact that tannic acid has been proven to withstand attempted hydrolysis with boiling dilute acids for many hours, and a five-year-old solution containing mould growths produced good clinical results.

Tannic acid is used to indicate the pharmacopoeial material; "gallotannin," that portion of the crude product precipitated by quinine. Tannic acid is considered to consist chiefly of gallotannin with gallic acid, water and other impurities.

Mitchell estimates the gallic acid content of tannic acid by precipitating the gallotannin with quinine hydrochloride, and colorimetrically determining the former in the filtrate with ferrous tartrate, using as a standard, gallic acid. Colors from the filtrate are slightly different from those of the pure acid. Due to adsorption which frequently occurs, it is necessary to add 15 per cent. to the figure determined. This establishes the standard error of all comparisons and results can be calculated to  $\pm 6$  per cent. of the gallic acid.

A complete analysis for gallic acid and gallotannin may be completed in 20 minutes. Mitchell's reagent gives a color with gallotannin similar to but not identical with that obtained with gallic acid. Matched in Nessler tubes with gallic acid colors, the result can be converted into gallotannin by means of a factor. Variations of 10-15 per cent. are considered insignificant, and may be accounted for by variation in materials, methods of manufacture and use.

A comparison of gauze compresses impregnated with tannic acid, and plain gauze compresses moistened with tannic acid solutions was carried out to determine differences. Gauze pieces were impregnated with enough tannic acid solution to make  $7\frac{1}{2}$  per cent. gauze, dried and separately soaked in measured volumes of water equivalent

to  $8\frac{1}{2}$  times the weight of the gauze. The expressed liquid was then analyzed. From the  $7\frac{1}{2}$  per cent. gauze but one-half the tannic acid was extracted, the per cent. extracted increasing slightly from those of higher concentration. This adsorption effect was expected. In testing tannic acid solutions before and after addition of gauze it was found that 45 per cent. is adsorbed in 5 minutes and 32 per cent. after 33 minutes. Although approximately one-half is inevitably adsorbed, it does not contraindicate the use of the compress method.

Due to differential adsorption the proportion of gallic acid in the extract decreases as the concentration of tannic acid rises, the gallic acid being less strongly adsorbed than gallotannin. In deterioration even though no hydrolysis occurs there will be an apparent rise in the proportion of gallic acid to gallotannin, which rise takes place as well in plain gauze immersed in fresh tannic acid solution. The rise in gallic acid content is not due to hydrolysis.

Two-year-old gauzes of various strengths were tested and showed that the weakest strength stored in ordinary packets had a greater proportion of gallic acid to gallotannin than did those in glass jars. However, the packet specimen yielded more gallotannin than did the other.

Extractions of total tannic acid with water and with alcohol were not effective; pure acetone acts slowly and incompletely and 40 per cent. acetone gives total extraction with high results and error of 6.3 per cent.

No antiseptics are necessary for mould growth prevention but are used for therapeutic purposes. Slowly volatile antiseptics are inadvisable to use. Antiseptic mercuric chloride is suggested as a possibility. Euflavine tannic acid gauze has been prepared though the euflavine is subject to adsorption. Phenylmercuric nitrate (1-20,000) in alcoholic solution added to the tannic acid solution has been satisfactorily employed.

Twenty per cent. or less hydrolysis of the gallotannin present occurs on sterilization in the autoclave of tannic acid gauze.

No definite deterioration was determined in tannic acid gauzes after twenty-seven months' storage.

M. H.

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**Gastric Irritation From Aspirin.** *Austral. J. Pharm.* 20, 475 (1939). A study of the effects of aspirin on the stomach has re-

cently been conducted by Douthwaite and Lintott who record their findings in "The Lancet." Although the number of patients under observation was small, the results were so definite that the authors came to the following conclusions:

In 80 per cent. of their cases, the gastric mucous membranes exhibited localized inflammations, due to aspirin, which ranged from slight to intense hyperemia and even to a development of submucous hemorrhage. All the varieties of aspirin produced the irritation, and no direct relationship between reaction and gastric acidity appeared to exist. The inflammatory reaction seemed to be most readily provoked on the lesser curvature of the stomach, and it is stated that it is confined to this area. The latter fact is interesting in view of the liability of the area to peptic ulceration. To ascertain if traces of salicylic acid present in some makes of aspirin were responsible for the gastric reaction, two patients were tested with the former substance in place of aspirin. Both showed a gastric reaction similar to that produced by aspirin, but in neither case was the reaction more intense than that from aspirin. Another series of cases was tested with calcium acetylsalicylate. In some of these patients no local or generalized reactions were observed, and in one patient only a slight local inflammation was noticed. It is suggested that the greater solubility of the calcium derivative is responsible for the less irritant effects. The authors conclude that aspirin is a gastric irritant and may be the cause of acute indigestion and hemorrhage, and, if taken regularly, chronic gastritis. If the drug be taken with milk or after food, it is probably without deleterious effect. They maintain that the calcium salt is less irritant than aspirin.

## SOLID EXTRACTS

By Ivor Griffith, Ph. M., Sc. D.

Despite the form in which this information is presented it may be accepted as trustworthy and up-to-date. Original sources are not listed but they may be obtained upon request.

Criminologists are attaching more importance to hair clues than previously. It is stated that the often neglected single hair is as important as a finger print. It is possible to prove that one hair can come from only one man. Inasmuch as a normal human being drops about 15,000 hairs in 1500 days, he rarely ever gets away from anywhere without leaving a hair behind. Sometimes when he leaves no finger prints or other clues he does leave a hair.

It is comparatively easy to collect all the hair in the place, eliminate those of innocent parties, and proceed to apprehend the others. Until now it has been possible to tell whether the suspect was red-headed, had dandruff, went bareheaded, whether he earned his living as a bank clerk, and so on. Now his or her exact age can be told.

The ring system is, basically, quite simple. Rings run around the hair at intervals along it, and not one inside of another as they do in a tree trunk or an onion. A young man's hair grows rapidly. Age makes it grow slower. This growing is not steady. A hair grows a while, then stops a while. Each stop or rest produces a discoloration at the point where the hair emerges through the scalp. This discoloration becomes a ring. If there are six rings to a tenth of a millimeter, the subject is 20. If there are twelve rings to the tenth of a millimeter, the subject is 40, and so on.

Whether this is "hairy persiflage" or not is a debatable matter, but it is, at least, interesting.

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*Now take castor oil!*

*The ability of castor oil to retain its viscosity when diluted with gasoline has for many years won it wide use as an engine lubricant. Now the adaptability of its ricinoleic acid molecule to alteration along desired lines promises to add the chemical industry as another mar-*

*ket. Sebacic acid, one raw material for nylon, the new completely synthetic fiber, is normally obtained by breaking up the ricinoleic acid molecule, although for the new fiber it may be synthesized from other sources. Other new castor oil products belong to that mysterious group, "surface-active chemicals," and facilitate the formation of emulsions and the penetration of liquids into fabrics, leather and similar substances. A promising new fly spray ingredient, derived from castor oil and dignified with the name isobutyl undecylenamide, when mixed with pyrethrum adds a lethal effect to the predominantly paralytic action of the latter.*

*Apparently industry in general will take castor oil with an eagerness equaled only by the reticence of its individual consumers.*

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And continuing our oily discourse,—who does not remember that awful concoction of rootbeer syrup, effervescing salts, water and castor oil commonly known as the "castor oil cocktail," a pleasant (*sic!*) way of taking this laxative liquid. Far better, and less blurry is the tri-layered complex of orange juice at the bottom, castor oil next, and closest to nose and mouth, a layer of compound tincture of cardaman.

That really does disguise the otherwise ship-sinking swill!

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*Larkspur and fishberries, once the arch enemies of nits and lice have a competitor in Vitamin B<sub>2</sub>. Soldiers in the present war may be spared at least one major discomfort that plagued their older brothers in 1914-1918, if the results obtained with vitamin B<sub>2</sub> on rats in the laboratories of Nobelist A. Szent-Gyorgyi at Budapest, Hungary, can be duplicated in human beings. He gave heavy feedings of the vitamin to rats badly infested with lice. The insects promptly left the rats.*

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Did you know that those who are inordinately addicted to tea and coffee are piling up a hardship on the constitution against the day when the physician will prescribe for them, as emergency medication in heart and kidney complaints, drugs closely allied to the caffeine

compounds contained in these beverages? Under such circumstances tea and coffee habitues would not respond to these emergency medications. Physicians know that those who drink coffee and tea to excess require much more caffeine medication in emergency.

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*Surgeons during the world war treated that dreaded disease of gas gangrene by cutting away as much tissue around the wound as possible and by treatment with antiseptic solution. If this did not help, amputation was resorted to in the effort to save life. Antitoxic serum has also been developed for fighting this deadly infection.*

*The newest weapon against this deadly gas gangrene is that medical wonder, sulfanilamide. This chemical remedy has, so far as is known, only been used in peace-time gas gangrene infections, but it is likely to play an important part in saving lives and limbs during the war. The speed with which the infection is brought under control by this treatment is "often startling," report doctors who have used it in peace-time practice.*

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Refrigerated blood—quarts and quarts of it—is another new, life-saving weapon that army surgeons may take to the front with them, and that hospitals will have ready for civilians wounded in air raids. The blood will be examined to make sure it contains no dangerous germs, typed, and transported by army trucks in specially constructed boxes that keep it at a temperature just above freezing. It will be ready for emergency use with no preliminary preparation other than warming it. Blood for this purpose can be obtained from civilians, from slightly wounded and convalescent soldiers, and even from the dead.

## BOOK REVIEWS

Done by persons, unafraid to upbraid, but perfectly willing to give praise where praise is really due.

**Manual of Toxicology.** By Forrest Ramon Davison, M. B., M. Sc., Ph. D., Assistant Professor of Pharmacology, University of Vermont. Paul A. Hoeber, Inc. \$2.50.

There has been during the past few months an epidemic of "toxicologitis"; this pocket-sized manual is another case of this disease. Frankly speaking we can see no crying need for another book of this type. The only difference between Davison's manual and the several others that have appeared recently is that it devotes a little more attention to the subject of food-poisoning than some of the others. It is disappointing to note that he has overlooked much of the recent literature on the treatment of poisoning; otherwise we can not explain the failure to mention such antidotes as sodium formaldehyde sulfoxylate for bichloride of mercury (he still recommends the old-fashioned egg-albumin for this poison) or sodium iodide for thallium. He does not even seem to have heard of Carbo Activatus of the U. S. Pharmacopœia. One strange omission from his book is all mention of the poisonous effects of the phenol group.

All things considered, while there is considerable interesting and valuable information in this book we do not regard it as a notable addition to medical literature.

H. C. Wood.

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**Experimental Pharmacology and Materia Medica.** (2d Edition.)

By Dennis E. Jackson. C. V. Mosby Company, 906 pages, 892 Illustrations, 1939. Price \$10.

This book, of which this represents the second edition, is a fine laboratory compendium. It is well illustrated with 892 line drawings and half tones and 55 color plates, and they are in no sense stereotyped illustrations such as are usually viewed in laboratory handbooks, but are painstakingly drawn and represent a real contribution to understanding. Nothing seems to be too insignificant to illustrate, and it suggests that the author has been more willing to err in the direction of comprehensiveness than to err in the direction of incompleteness. Certainly no economy has been spared in compiling the book. Most of the color illustrations are the work of

Halleck, which appeared in the first edition of Jackson published twenty-two (22) years ago. Originals of this volume have been much sought after, but rarely found. The reproduction of these illustrations will be welcomed by many. The subject matter is in good arrangement and the experiments seem to have been compiled and arranged according to good modern practice in pharmacology. Nearly 200 pages at the end of the book are dedicated to *materia medica* and prescription writing, which practically means that nearly a quarter of the book is specifically set apart for this very practical feature of the medical student's training in this field. When one realizes the lack of such training evidenced by the modern graduate of a medical school, one is tempted to compliment the author of this splendid work on a very sensible attitude toward the need of teaching medical students this extremely important subject. Some difference of opinion, however, may be had as to the color chart methods which are used to teach posology, and exception may be taken to the color schemes involved, for they certainly are not, in any sense, true to originals. On the other hand, nobody would know quite as well as the author just how effective this type of teaching aids might be, for so often the way in which they are used is of much more consequence than the aids themselves.

In Part II, we find a chapter devoted to shop work, and another on photography—detailing the construction of many items used in the laboratory. This information is rarely found in texts and should be of particular usefulness to the student. The chapter on photography unfortunately contains little about present-day methods but does give a sound general idea of the principles involved.

All in all, we regard this book as an honest and a serious contribution to the laboratory teaching of pharmacology, and we can heartily recommend it on the basis of its practicality and completeness. The several tables at the end of the book are particularly useful, although it must be admitted that the English-Latin vocabulary is extremely compressed and scarcely covers even the terms and idioms commonly used in prescription work. Especially useful is the list of firms supplying the equipment so adequately pictured in the book.

We regard this volume as indispensable to the teacher and student in experimental pharmacology and *materia medica*, and we accordingly heartily recommend it.

J. W. E. HARRISON.